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GB 2249272 A EP 0557096 A1 EP 0489565 A1
US 5062870 A US 4853008 A

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(54) Shroud for cyclone separator

(57) A shroud (10; 40) for use in apparatus incorporating cyclonic dust separation means for separating dirt and dust from an airflow, (10; 40) comprises a perforated portion (14; 44) having a multiplicity of perforations (30; 46) for allowing the airflow to pass therethrough. According to a first aspect of the invention, the upstream edge of each perforation (30) meets the upstream surface (28) of the shroud (10) at a sharply defined angle. According to a second aspect of the invention, the perforated portion (14) has a lower edge (16) and a lip (18) depending therefrom, the lip (18) comprising a parallel-sided portion (34) having an inclined distal end and a step (38) formed radially inwardly of the parallel-sided portion (34) and at the proximal end thereof. According to a third aspect of the invention, the perforated portion (44) is frusto-concial in shape and the diameter (d) of each perforation (46) is substantially 2.2mm. Each of these aspects improves the performance of the dust separation apparatus in which the shroud (10; 40) is utilised.

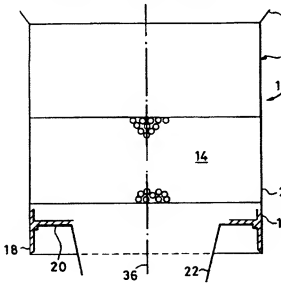

FIG.1

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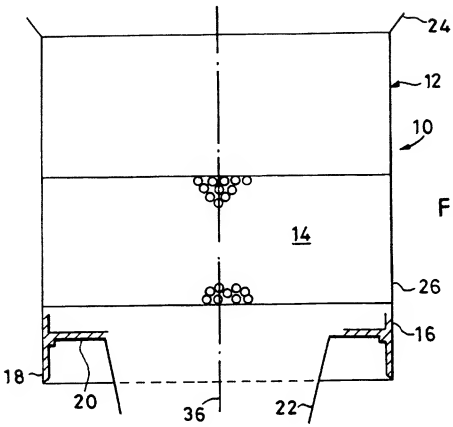

FIG.1

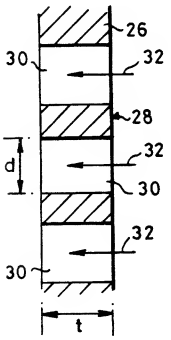

FIG.2a

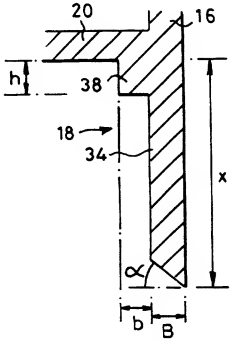

FIG.2b

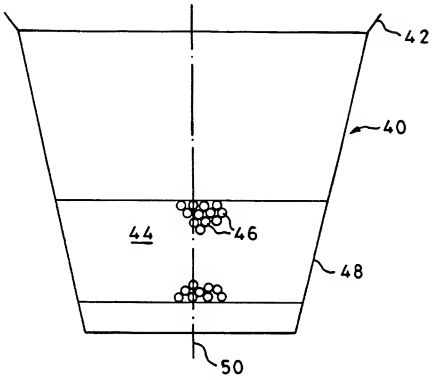

FIG.3

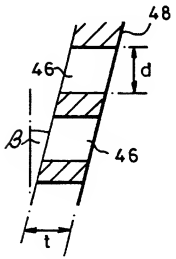

FIG.3a

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IMPROVED SHROUD

The invention relates to an improved shroud and to apparatus incorporating an improved shroud.

A shroud is used in conjunction with cyclonic dust separation means to filter an airflow. In apparatus incorporating dual cyclonic separation means, ie. two separate cyclones arranged in series to remove, initially, larger pieces of dirt and fluff and, subsequently, finer dust particles, the shroud is positioned between the two cyclone arrangements and the airflow is passed through the shroud to reduce the possibility of larger pieces of dust and fluff entering the second, high efficiency cyclone.

It has been found that various features of the shroud have an effect on the overall performance of the separation means. It is therefore an object of the invention to provide a shroud which improves the overall performance of the cyclonic dust separation means in conjunction with which it is used.

The invention provides, according to a first aspect thereof, a shroud as claimed in claim 1. The invention also provides, according to second and third aspects thereof, a shroud as claimed in claims 16 and 24.

Advantageous and preferable features are set out in the subsidiary claims. When used in conjunction with dual cyclonic separation means, these arrangements improve the percentage of dirt, dust and fluff remaining in the low efficiency cyclone which, in turn, improves the performance of the high efficiency cyclone and thus of the entire separation means.

Embodiments of the invention will now be described with reference to the accompanying drawings, wherein:

Figure 1 is a side view, partially in section, of a first embodiment of a shroud incorporating the first and second aspects of the present invention;

Figure 2a is an enlarged sectional view of part of the wall of the perforated portion of the embodiment shown in Figure 1;

Figure 2b is an enlarged detail of the embodiment shown in Figure 1;

Figure 3 is a side view of an embodiment of the third aspect of the present invention; and

Figure 3a is an enlarged section through part of the wall of the perforated section of the embodiment shown in Figure 3.

Figure 1 shows a shroud 10 having a cylindrical portion 12 in which is located a perforated portion 14. The perforated portion 14 has a lower edge 16 from which depends a lip 18 which will be described in greater detail below. Extending radially inwardly from the

lower edge 16 of the perforated portion 14 is an annular web 20 which communicates with or seals against an inner cyclone 22. The inner cyclone 22 forms no part of the present invention and will not be described in any further detail here. The web 20 effectively forms support means for and a seal against the cylindrical portion 12. Further support and sealing means 24 are located at the upper edge of the cylindrical portion 12 but which, again, does not form part of the present invention, except to support the cylindrical portion 12.

Figure 2a shows, in sectional view, a portion of the wall 26 forming the perforated portion 14. The wall 26 has an upstream surface 28 and a multiplicity of perforations 30 through which, in use, the airflow passes in the direction of arrows 32. In prior art shrouds, the perforations have been formed in such a manner that the upstream edge of each perforation incorporates a radius at its intersection with the upstream surface of the shroud. According to the present invention, the upstream edge of each perforation 30 meets the upstream surface 28 at a sharply defined angle. Such an angle can be produced by forming the perforations 30 by drilling or, if desired, by moulding or any other suitable manufacturing process. The provision of a sharp angle at the intersection between the upstream edge of each perforation 30 and the upstream surface 28 of the shroud 10 decreases the

amount of fine dust passing through the perforations 30 and therefore decreases the risk of the perforations 30 becoming blocked by dust and fluff particles.

The thickness of the material t forming the wall 26 is substantially 2mm. The diameter d of each cylindrical perforation 30 is substantially 2.2mm.

The embodiment shown in Figure 1 includes a lip 18 depending from the lower edge 16 of the perforated portion 14. The lip 18, which is shown in more detail in Figure 2b, essentially comprises a parallel sided portion 34 extending substantially parallel to the longitudinal axis 36 of the shroud 10. The distal end of the parallel-sided portion 34 is inclined at an angle α of substantially 45°. At the proximal end of the lip 18, a step 38 is formed, the breadth b of the step 38 being substantially the same as the breadth B of the parallel-sided portion 34. Both the breadth b and the breadth B are, in the embodiment shown, substantially 2mm.

The height h of the step 38 corresponds substantially to the breadth b of the step 38 and, again, is approximately 2mm in this embodiment.

The distance x to which the lip 18 extends below the lower edge 16 of the perforated portion 14 is approximately 15mm.

It has been found that this shape of bottom lip 18 of the shroud 10 reduces the amount of blockage of the

perforations 30 in the shroud 10 and the amount of fine dust passing through the perforations 30 when used in dual cyclonic vacuum cleaning apparatus with the shroud 10 being positioned in the airflow path between a low efficiency cyclone and a high efficiency cyclone. A relatively large proportion of dirt and dust is retained in the low efficiency cyclone and the step 38 also improves the seal between the lip 18 and the lower edge 16 of the perforated section 14.

Figure 3 illustrates a third aspect of the invention. In Figure 3, a frusto-conical shroud 40 is illustrated having support means 42 located at the upper end thereof. A frusto-conical perforated portion 44 is located in the frusto-conical shroud 40. A multiplicity of perforations 46 are arranged in the perforated portion 44 and Figure 3a is a sectional view through part of the side wall 48 of the perforated portion 44.

As can be seen from Figure 3a, the thickness t of the material forming the side wall 48 of the shroud 40 is substantially 2mm. Also, the diameter d of each cylindrical perforation 46 is substantially 2.2mm. The longitudinal axis of each perforation 46 is substantially perpendicular to the longitudinal axis 50 of the shroud 40.

In the embodiment shown, the angle of inclination β of the side wall 48 to the longitudinal axis 50 of the shroud 40 is substantially 12.5°. However, this

angle could be varied according to the requirements of the cyclonic dust separating apparatus and particularly to the angle of inclination of the inclined wall of the high efficiency cyclone. The angle of inclination β is preferably substantially identical to the angle of inclination of the wall of the high efficiency cyclone so that the wall 48 of the shroud 40 can be located parallel to the inclined wall of the high efficiency cyclone whilst still providing for the passage of air between the perforations and the high efficiency cyclone.

It has been found that the provision of perforations 46 having a diameter of 2.2mm is advantageous in that the amount of fine dust passing through the shroud is reduced thus reducing the likelihood of the shroud becoming blocked by dust or fluff. The provision of a conical shroud 40 increases the volume of the area of the low efficienct cyclone in which dirt and dust is collected thus increasing the capacity of the cyclone.

It will be appreciated by a skilled reader that the invention is not limited to the embodiments illustrated above. Various modifications and alterations will be apparent to the skilled reader as falling within the scope of the invention.

CLAIMS

1. A shroud for use in apparatus incorporating cyclonic dust separating means for separating dirt and dust from an airflow, the shroud having an upstream surface and comprising a perforated portion having a multiplicity of perforations for allowing the airflow to pass therethrough, wherein the upstream edge of each perforation meets the upstream surface of the shroud at a sharply defined angle.

2. A shroud as claimed in claim 1, wherein the sharply defined angle is substantially 90°.

3. A shroud as claimed in claim 1 or 2, wherein each perforation is cylindrical and has a diameter of substantially 2.2mm.

4. A shroud as claimed in any one of the preceding claims, wherein the thickness of the perforated portion in the longitudinal direction of the perforations is substantially 2mm.

5. A shroud as claimed in any one of the preceding claims, wherein the perforated portion is cylindrical.

6. A shroud as claimed in any one of the preceding

claims, wherein the shroud further comprises a lip depending from a lower edge of the perforated portion.

7. A shroud as claimed in claim 6, wherein the lip comprises a parallel-sided portion having an inclined distal end.

8. A shroud as claimed in claim 7, wherein the distal end is inclined at an angle of substantially 45° to the parallel sides of the lip.

9. A shroud as claimed in claim 7 or 8, wherein the parallel sides of the lip extend substantially parallel to the longitudinal axis of the shroud.

10. A shroud as claimed in any one of claims 7 to 9, wherein the lip extends between 10mm and 20mm below the lower edge of the perforated portion.

11. A shroud as claimed in claim 10, wherein the lip extends substantially 15mm below the lower edge of the perforated portion.

12. A shroud as claimed in any one of claims 7 to 11, wherein the lip is broader in cross-section at its proximal end than at its distal end.

13. A shroud as claimed in claim 12, wherein the lip comprises a step formed radially inwardly of the parallel-sided portion at the proximal end thereof.

14. A shroud as claimed in claim 13, wherein the breadth of the step is substantially equal to the breadth of the parallel-sided portion.

15. A shroud as claimed in claim 13 or 14, wherein the height of the step is substantially equal to the breadth thereof.

16. A shroud for use in apparatus incorporating cyclonic dust separation means for separating dirt and dust from an airflow, the shroud comprising a perforated portion having a lower edge and a lip depending therefrom, the lip comprising a parallel-sided portion having an inclined distal end, wherein a step is formed radially inwardly of the parallel-sided portion and at the proximal end thereof.

17. A shroud as claimed in claim 16, wherein the breadth of the step is substantially equal to the breadth of the parallel-sided portion.

18. A shroud as claimed in claim 16 or 17, wherein the height of the step is substantially equal to the breadth

thereof.

19. A shroud as claimed in any one of claims 16 to 18, wherein the breadth of the parallel-sided portion is substantially 2mm.

20. A shroud as claimed in any one of claims 16 to 19, wherein the parallel-sided portion extends substantially parallel to the longitudinal axis of the shroud.

21. A shroud as claimed in any one of claims 16 to 20, wherein the lip extends substantially 15mm below the lower edge of the perforated portion.

22. A shroud as claimed in any one of claims 16 to 21, wherein the distal end of the lip is inclined at an angle of substantially 45° to the parallel sides of the lip.

23. A shroud as claimed in any one of claims 16 to 22, wherein the perforated portion is cylindrical.

24. A shroud for use in apparatus incorporating cyclonic dust separation means for separating dirt and dust from an airflow, the shroud having a frusto-conical perforated portion having a multiplicity of cylindrical perforations for allowing the airflow to pass

therethrough, wherein the diameter of each perforation is substantially 2.2mm.

25. A shroud as claimed in claim 24, wherein the angle of inclination of the frusto-conical portion to the longitudinal axis of the shroud is between 10° and 20°.

26. A shroud as claimed in claim 25, wherein the said angle of inclination is substantially 12.5°.

27. A shroud for use in apparatus incorporating cyclonic dust separation means for separating dirt and dust from an airflow, substantially as hereinbefore described with reference to any one of the embodiments shown in the accompanying drawings.

28. Apparatus for separating dirt and dust from an airflow comprising cyclonic dust separation means and a shroud according to any one of the preceding claims.

29. Apparatus as claimed in claim 28, wherein the cyclonic dust separation means comprise a low efficiency cyclone and a high efficiency cyclone positioned downstream of the low efficiency cyclone, the shroud being positioned between the two cyclones.

30. Apparatus as claimed in claim 28 or 29, wherein the apparatus consists of a vacuum cleaner.

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report)	Application number GB 9426287.0
Relevant Technical Fields (i) UK Cl (Ed.N) B1T (TBEB, TDPA, TNAB); B2P; B1D (DBEB, DDPA) (ii) Int Cl (Ed.6) A47L-9/16; B04C-5/26; B04C 11/00	Search Examiner MR G BRIDGES Date of completion of Search 29 MARCH 1995
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) ONLINE: WPI	Documents considered relevant following a search in respect of Claims :- 1-15 PLUS CLAIMS 27-30 IN PART

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E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
A	GB 2249272 A	(NOTETRY LTD)	1
A	EP 0489565 A1	(NOTETRY LTD)	1
A	US 5062870 A	(NOTETRY LTD)	1
A	US 4853008 A	(NOTETRY LTD)	1

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(The Search report)

Application number
GB 9426287.0

Relevant Technical Fields

(i) UK Cl (Ed.N) B2P; B1T (TNAB)

(ii) Int Cl (Ed.6) A47L 9/16; B01D 45/12; B04C 5/12, 5/14, 5/185, 5/187, 5/26, 11/00

Search Examiner
MR G BRIDGES

Date of completion of Search
26 APRIL 1995

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE: WPI

Documents considered relevant following a search in respect of Claims :- 16-23 PLUS CLAIMS 27-30 IN PART

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Category	Identity of document and relevant passages		Relevant to claim(s)
A	EP 0557096 A1	(IONA APPLIANCES INC) see eg Figures 4, 6	16, 23
A	EP 0489565 A1	(NOTETRY LIMITED) see eg Figures 2B, 2C	16, 20, 23
A	US 4853008 A	(NOTETRY LIMITED) see eg Figure 2	16, 20, 23

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Patents Act 1977 **Examiner's report to the Comptroller under Section 17 (The Search report)**	Application number GB 9426287.0
Relevant Technical Fields (i) UK Cl (Ed.N) B2P; B1T (TNAB) (ii) Int Cl (Ed.6) A47L 9/16; B01D 45/12; B04C 5/12, 5/14, 5/185, 5/187, 5/26, 11/00	Search Examiner MR G BRIDGES Date of completion of Search 26 APRIL 1995
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) ONLINE: WPI	Documents considered relevant following a search in respect of Claims :- 24-26 PLUS CLAIMS 27-30 IN PART

Categories of documents

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&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
Y	EP 0489565 A1	(NOTETRY LIMITED) see column 11 line 54 - column 12 line 16	24-26, 28-30
Y	US 5062870 A	(NOTETRY LIMITED) see column 9 lines 1-9	24-26, 28-30
Y	US 4853008 A	(NOTETRY LIMITED) see Figure 2	24-26, 28-30

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